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SPINNER CLEANING AND DRYING DEVICES

CLAIM(S)

A spinner cleaning and drying device, wherein a whirlpool chamber having a nearly circular aperture is installed on the surface of the rotatable supporting table supporting the substrate; an introducing port is made in the side wall of the whirlpool chamber; from the introducing port, a compressed gas or a pressurized fluid is jetted out into the whirlpool chamber to generate the whirlpool; by using the negative pressure generated in the whirlpool chamber by said whirlpool, the substrate is supported by floating it from the surface of the supporting table.

DETAILED DESCRIPTION OF THE INVENTION

The present invention pertains to a spinner cleaning and drying device.

In the manufacturing process of a mask used for manufacturing a semiconductor integrated circuit, a high level of cleaning is required for removing 1 micron size foreign substances that are attached to a glass substrate and a mask substrate on which is formed a chromium film.

As one prior art method for cleaning such a substrate, there is a method, wherein by using multiple units of supersonic cleaning tub, the substrate is cleaned with a solution containing nitric acid or a detergent, subsequently cleaned with purified water, and finally dried with isopropyl alcohol or Freon steam. With this method, however, it is difficult to acquire a sufficient cleaning level required for the mask substrate, and there is a problem that pin holes are generated in the film formed after the glass substrate was cleaned. As the method free from the problems with the aforementioned method, there is a method, wherein the substrate is mounted to the rotatable supporting table, and after the substrate is cleaned by bringing the rotating brush in contact with the substrate surface or blowing high pressure purified water onto the substrate surface while rotating the supporting table, the supporting table is rotated at relatively high speed to dry the substrate by centrifugal dewatering. With the presently known spinner cleaning and drying devices that implement the latter method, the substrate is attached to the supporting table by vacuum suction in every

spinner cleaning and drying device. Therefore, problems arise that the back surface of the substrate is scratched and contaminated and that the back surface is not sufficiently dried.

The present invention was produced to solve the aforementioned problems, and attempts to present a spinner cleaning and drying device, by which the back surface of the substrate is not scratched, nor contaminated, and can be sufficiently dried.

In the structure of the device of the present invention that implements the aforementioned objective, a whirlpool chamber having a nearly circular aperture is installed on the surface of the rotatable supporting table supporting the substrate; an introducing port is made in the side wall of the whirlpool chamber; from the introducing port, a compressed gas or a pressurized fluid is jetted out in the whirlpool chamber to generate the whirlpool; by using the negative pressure generated in the whirlpool chamber by this whirlpool, the substrate is supported by floating it from the surface of the supporting table.

The present invention is explained below with reference to the drawings.

Fig. 1 shows a planar view of one embodiment example indicating the key components of the spinner cleaning and drying device of the present

invention. Fig. 2 shows a sectional view of the A – A section of Fig. 1. In Fig. 1 and Fig. 2, 1 indicates the rotatable supporting table for supporting the substrate 0. On the surface of this supporting table 1, is installed the whirlpool chamber 2 having a circular aperture and, in the side wall of this whirlpool chamber 2, is made an introducing port 3 opened in the tangential direction to the side wall; 4 indicates a protrusion secured to the end section of the supporting table 1 and this protrusion controls the substrate 0 from sliding; 5 indicates a cylindrical casing which has a flange 6 at its one end section. The inner surface of this casing 5 and the back surface of the supporting table 1 constitute the pressure chamber 7; 8 indicates the rotary shaft driven by a motor (not shown in the figures), and in the center of the rotary shaft, is formed a supplying path 9 into which the compressed gas or pressurized fluid is fed; 10 indicates the supplying section of compressed gas or pressurized gas, and the supplying path 9 of the rotary shaft is opened to this supplying section 10; 11 indicates a flat countersunk head screw connecting the supporting table 1 and the casing 5; 12 indicates a bolt connecting the casing 5 and rotary shaft 8; 13 and 14 indicate an O ring to seal the gap of the aforementioned connection sections.

An instance wherein the substrate is cleaned by using the spinner cleaning and drying device structured as mentioned above is explained below.

First, the compressed gas is supplied from the supplying section 10 to the pressure chamber 7 by using supplying path 9 in the rotary shaft 8. The compressed gas supplied to the pressure chamber 7 goes through the introducing port 3, is jetted out into the whirlpool chamber 2, flows in the circumferential direction along the side wall of the whirlpool chamber 2, generates the whirlpool in the whirlpool chamber 2, and subsequently flows to the outside. Once the substrate 0 is placed on the surface of the supporting table 1 under this condition, the substrate 0 is sucked to the supporting table 1 by the negative pressure generated by the aforementioned whirlpool. However, since the gas flows out toward the end of the supporting table 1 from between the substrate 0 and the supporting table 1, the substrate 0 remains floating from the substrate table 1. In other words, the back surface of the substrate 0 is supported without contacting with the supporting table 1. Under this condition, the surface of the substrate is cleaned by using the means of rotary brush or of blowing high pressure water (not shown in the figures) while rotating the supporting table 1, and

subsequently, the supporting table 1 is rotated at relatively high speed to dry the substrate by centrifugal dewatering.

Accordingly, since the back surface of the substrate 0 is supported without contacting with the supporting table 1, the contamination and scratches are not generated on the back surface of the substrate 0, and also, the back surface is sufficiently dried. If the back surface of the substrate 0 needs to be cleaned with purified water, purified water instead of compressed gas is supplied from the supplying section 10, and subsequently, the compressed gas can be supplied at the time of drying.

Fig. 3 shows one example of the substrate suction force in the spinner cleaning and drying device of the present invention. The figure shows the relationship between the pressure P of compressed gas and the suction force F under the following parameters: 40 mm inner diameter of whirlpool chamber 2; 20 mm depth; 2 mm inner diameter of introducing port 3. As is evident from the graph, the suction force F is 0.7 Kg even when the compressed gas pressure P is 1 kg/cm^2, so the substrate 0 does not fall off during the rotation of supporting table 1.

As to the aforementioned compressed gas, an air or a nitrogen gas is used, and as to the pressurized fluid, water is used. As to the height of the protrusion 4 for preventing the substrate 0 from falling, the sum of the

thickness of the substrate 0 and of the floating height of the substrate 0 from the supporting table 1 is sufficient.

In the aforementioned example, one whirlpool chamber 2 is installed on the supporting table 1, but the supporting table 1 may be divided into two or more supporting tables (1a, 1b, 1c, 1d) and the whirlpool chamber 2 may be installed on each of these supporting tables, as shown by the planar view in Fig. 4 and by the sectional view of the section B-B of Fig. 4 shown in Fig. 5. The spinner cleaning and drying device of the present invention is applicable not only to cleaning and drying a square mask substrate but also to cleaning and drying a circular semiconductor wafer or sheets in different sizes.

As explained above, the spinner cleaning and drying device of the present invention can clean the substrate without scratching or contaminating the back surface, and the back surface can be sufficiently dried.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a planar view of one embodiment example of the present invention indicating the key components. Fig. 2 shows the A – A section of Fig. 1. Fig. 3 shows one example of the substrate suction force in the spinner cleaning and drying device of the present invention. Fig. 4 shows a

planar view of the spinner cleaning and drying device as another embodiment example. Fig. 5 shows the B – B section of Fig. 4.

1. supporting table

2. whirlpool chamber

3. introducing port

4. protrusion

5. casing

6. flange

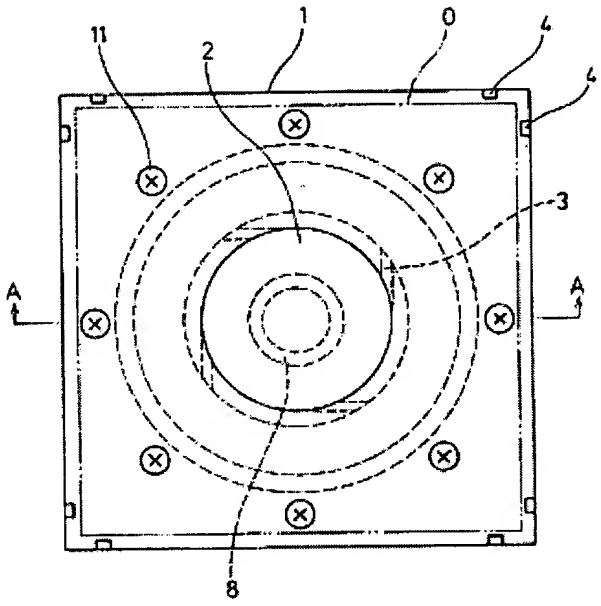
7. pressure chamber

8. rotary shaft

9. supplying path

10. supplying path

第 1 図



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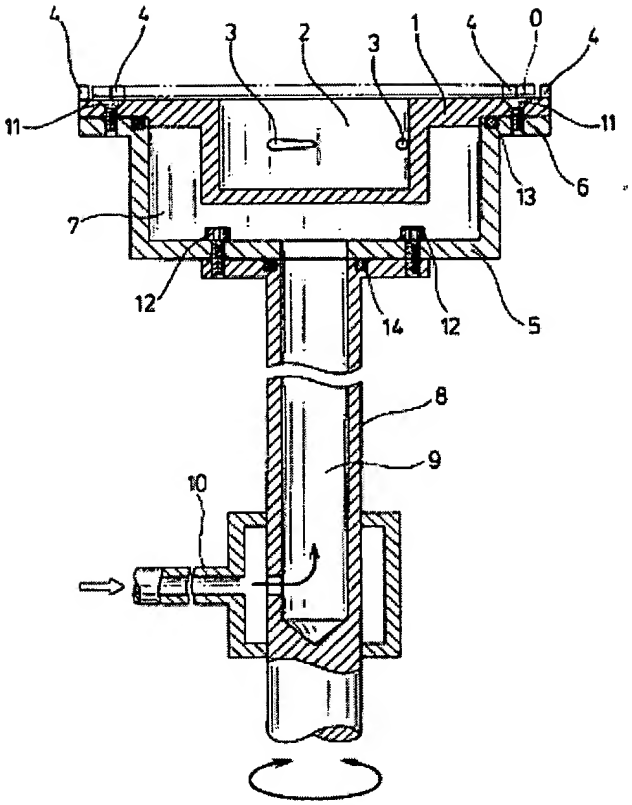

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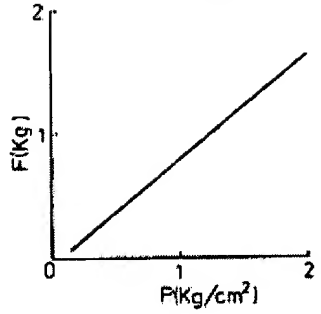

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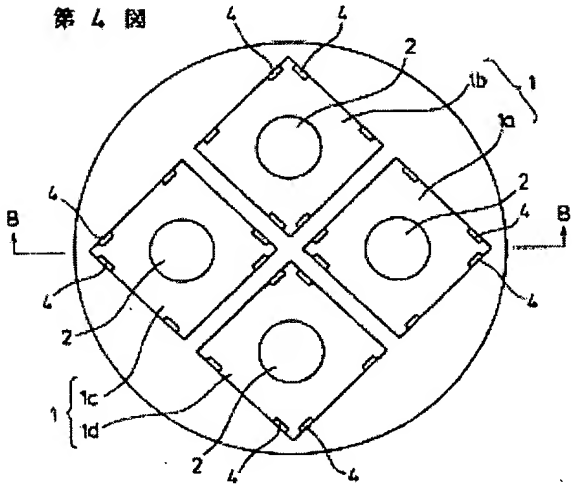

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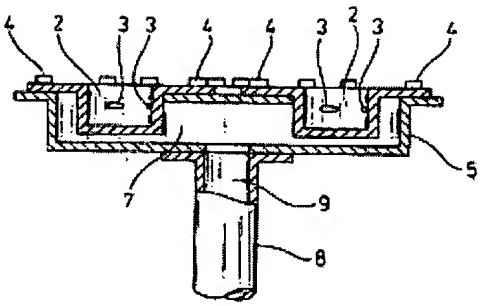

Translations
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